

Original Communication

The processing of skeletonized human remains found
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Abstract

During World War II, and particularly the Battle of Berlin, many thousands of civilians and soldiers from a variety of countries were killed. Given the nature of the intense aerial and ground bombardments bodies were often fragmented and buried beneath rubble resulting in many individuals, who were presumed to have been killed, not being identified. Skeletal remains are continually being uncovered in Berlin, particularly with accelerated building developments following German re-unification. A retrospective study was undertaken of records over a 10-year period from 1997 to 2006 to demonstrate the method of processing of skeletal material and to show the results of such analyses. Over the period of the study, 257 cases were investigated (approximately 26 per year). As bones were found in multiple areas at each site, this represented 290 collections of bones from the 257 sites. Only nine complete skeletons were found with a total of 40,344 single or fragmented bones. In 1997, a huge number of bones were unearthed during major construction work at Potsdamer Platz and the central railway station (Lehrter Bahnhof). This gave rise to 29,602 bones and fragments, excluding animal remains. Despite the passage of time, successful identification of remains is still occurring, with 44 individuals positively identified over the 10 years of the study, including eight in 2006.

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1. Background

Berlin, situated in the east of Germany, is the country's capital and is a city of approximately 3.45 million people. The city began as two small trading posts that merged in the 14th century. Although ravaged by the Thirty Year's War from 1618 to 1648, by the latter part of the 17th century Berlin had risen to become the capital of Prussia under Friederich I. Part of this renaissance involved the encouragement of foreign settlement including Jewish families from Vienna and Huguenot refugees from France. The city continued to suffer troubled times and was occupied by the French for seven years during the Napoleonic wars. Later

in that century the city again prospered and the population doubled under the influence of the Industrial Revolution. Political instability, however, followed World War I in the next century and led to the rise of the Nazi party in the 1930s. World War II followed and saw large-scale devastation to both the structure and people of Berlin, with continued bombing by Allied aircraft from 1943 to 1944. In April 1945, the 'Battle for Berlin' occurred with the invasion of 1.5 million Soviet soldiers. Widespread loss of civilian life with thousands of military casualties occurred during the intense street fighting that followed.¹

2. Recovery of human remains

Given the extensive damage to buildings and infrastructure that occurred during World War II (Fig. 1), the number of casualties, and the chaos of the final months of the

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Fig. 1. Widespread destruction of buildings and infrastructure occurred during both allied bombing raids and the Battle of Berlin as shown by this picture of the Brandenburg Gate and surrounds in 1945.

war in Berlin, it is not surprising that many bodies remain unaccounted for. Destruction and dismemberment of bodies by artillery fire, bombs, fires and burial in collapsed buildings would account for many of the missing victims. However, accelerated building programs in Berlin following the re-unification of Germany has resulted in the continued recovery of numbers of incomplete human remains from building sites.² The following paper details the methods of processing such a large amount of human bones type and the range of skeletal material that has been unearthed.

3. Processing of unidentified skeletal remains

When unknown skeletonised human remains are found in Berlin the standard process is for police evaluation to

occur. If the remains are considered to be most likely historical due to their condition and associated objects such as coins, newspapers and clothing (Fig. 2), and not those of a recent concealed homicide or other death, they are gathered and transferred to the local forensic institution for evaluation by a pathologist. On occasion, in building sites where remains from the war are either known to be present, or are likely to be found, collection of the material may be overseen by the supervisory building contractor.

Significant problems occur with such remains. Due to the nature of the battle and subsequent excavations skeletons are generally incomplete with commingling and fragmentation of bones (Fig. 3). The possibility of unexploded ordinance must also always be considered. Once excavated, boxes may arrive at the institute filled with hundreds of pieces of ribs, long bones and vertebrae



Fig. 2. Remnants of boots and shoes recovered with skeletal remains.



Fig. 3. Commingled remains consisting of relatively intact skulls and pelvises from a number of individuals.



Fig. 4. More fragmented remains with vertebrae, ribs and portions of long bones.

(Fig. 4). On occasion, bags of similar bone fragments will be found that have been concealed at another site – presumably representing material from building sites that was removed without correct notification of the authorities.

The remains are given an institute accession number and are examined for any identifying features or associated materials such as military clothing, helmets, weapons or identification tags (Figs. 5 and 6). Rings and jewellery are also photographed and documented. The remains are X-rayed and checked for any ordinance that might require special handling, and then cleaned and laid out.

An attempt will be made to determine the minimum number of individuals represented by the remains, with age and sex determinations if discrete near whole skeletons have been found. Changes from diseases such as osteoarthritis or healed fractures are recorded (Fig. 7). Selected



Fig. 5. A corroded Wehrmacht helmet.



Fig. 6. A corroded bayonet.



Fig. 7. A fracture through an established callus at the site of a previous healed fracture.

injuries, lesions and post-mortem artefacts are also photographed and documented and a report is generated for the police detailing the results of the examinations and the conclusions.

If accompanying materials such as identity discs (Fig. 8) are present, the case is referred to the Wehrmacht Information Office for War Losses (Deutsche Dienststelle – WAST),



Fig. 8. A German army identity tag.

an authority under the Federal State of Berlin, for identification and possible family follow up (see below). Unfortunately, the condition of such discs is often poor complicating their evaluation. Unidentified military remains are cremated and buried in a military cemetery and remains that are most likely to be civilian are cremated and buried in non-military cemeteries.

4. Nature of the material

In the 10-year period from 1997 to 2006, 257 cases were investigated (approximately 26 per year). As bones were found in multiple areas at each site, this represented 290 collections of bones from the 257 sites. Only nine complete skeletons were found with a total of 40,344 single or fragmented bones. Forty-four cases were positively identified including 40 Wehrmacht (German Armed Forces) and two Soviet soldiers. In 1997, a huge number of bones were unearthed during major construction work at Potsdamer Platz and the central railway station (Lehrter Bahnhof). This gave rise to 29,602 bones and fragments excluding animal remains. The results of dental work on 176 cases from 1993 to 2001 has previously been published.²

Examples of military equipment that have been found with skeletonised remains include standard German World War II army issue helmets, identification tags, parts of uniforms (particularly belts and boots), weapons such as firearms and bayonets, drinking bottles and sometimes personal papers including identification documents.

5. Identification

Two of the major functions of the identification process are to confirm that the remains are human (or not) and to exclude a victim's remains from a 'contemporary' concealed homicide. While this may not be possible, multiple fragmented remains from apparently the same time, in an area or building known to have been damaged or destroyed during the war, provide reasonable circumstantial evidence for war-related deaths. Not infrequently animal bones are recovered either alone or commingled with human remains.² These are identified and discarded. As noted above, remnants of uniforms, weapons and military equipment may also give some indication as to whether a deceased individual was a soldier or a civilian. While identification is generally not possible, the characteristic features of remains may permit determination of gender and estimation of age, and sometimes causes of death.^{3,4} Dental

identification has also been successfully undertaken⁵ and international guidelines for odontological identifications have been established.⁶ Radiographic studies may also be used to confirm identification if pre-existing medical and/or X-ray records are still available.^{7,8} On occasion remnants of identity papers will still be preserved. This occurred with human remains from a Luftwaffe (German Airforce) Junkers Ju 88 that was found in a field outside Hamburg nearly 60 years after the crash enabling the pilot to be identified.⁹

DNA analyses of remains from both world wars have been successfully undertaken when documentation is found with a victim to enable tracing of family members for testing, and has been used in identifying victims from mass graves in more recent times.¹⁰ Such DNA identification was used in one of the 44 individuals identified over the past 10 years in Berlin with presumptive identification being made on remnants of the uniform found with the body, and confirmed with family studies. DNA analyses have also been successfully undertaken in identifying specific historical individuals, and were responsible for confirming that the nine skeletons found in a shallow grave in Ekaterinburg, Russia in July 1991 were those of Tsar Nicholas II, his wife and three of his daughters.¹¹ Similarly, mitochondrial DNA sequencing confirmed that the remains found near Lehrter Bahnhof in 1972 were those of Martin Bormann, Adolph Hitler's private secretary who had last been seen on the night of May 12, 1945 escaping from the führerbunker.¹² DNA identification may even be possible from remains that have been submerged in water for considerable periods.¹³

Despite the passage of time, Table 1 demonstrates that successful identification of remains is still occurring, with 44 individuals positively identified over the 10 years of the study, including eight in 2006. Identifications in 43 of the 44 individuals were made by decoding identity discs found with the remains.

6. Wehrmacht information office for war losses

The Deutsche Dienststelle (WASt) was established before WWII to provide a registry for foreign prisoners of war and Wehrmacht casualties (<http://dd-wast.java-base.de>). The role of the office was increased substantially after the war to assist in the identification and registration of not only former Wehrmacht soldiers, but also members of other military and paramilitary groups. The office houses records for over 18 million veterans including infor-

Table 1
Features and numbers of skeletal material submitted for forensic evaluation in Berlin, Germany (1997–2006)

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Numbers of sites investigated	33	21	23	21	20	22	35	24	30	28
Separate collections of bones	40	23	25	23	23	24	40	27	35	30
Number of positive identifications	5	2	4	5	4	4	6	2	4	8
Number of single bones/fragments	29,602	633	107	699	1040	1353	1322	638	4320	630

mation about postings, unit losses and personal documents. There are also 16.5 million files on German, Austrian and foreign prisoners of war. The office is involved in assisting with the identification of remains by decoding identity discs and providing supporting documentation when requested. A certificate can also be issued once the identity of a person has been established confirming death in action.

7. Cause of death

While loss of organs and soft tissues, and fragmentation of bones due to trauma at the time of death and subsequent damage associated with excavation makes evaluation of causes of death difficult, occasional cases are found where bony injuries give an indication of possible lethal events. These include bullet holes in skulls, shrapnel damage or staining from projectiles. Single frontal, temporal or particularly occipital gunshot wounds may be taken as presumptive evidence of execution (Fig. 9).

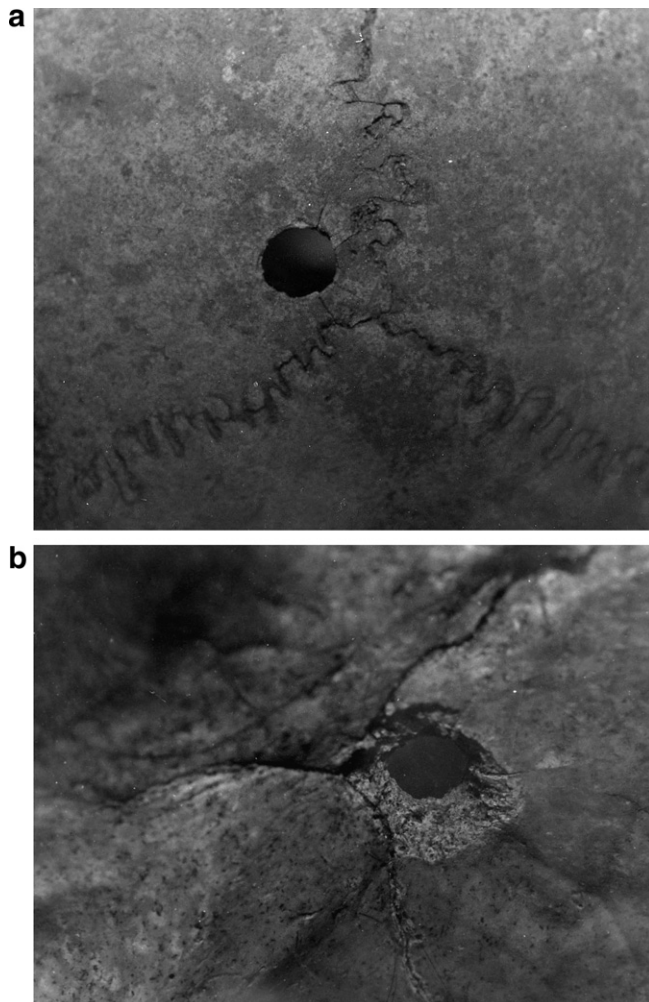


Fig. 9. An 'execution style' entrance bullet wound to the posterior occiput showing internal bevelling (a and b).

8. Differences in materials from different regions

The nature of skeletonised material that is submitted for forensic assessment depends largely on the history, ethnic composition and cultural practices of the area where this is undertaken. For example, in more recent times such remains have been unearthed in the Balkans associated with mass killings during 'ethnic cleansings' among rival groups. Such remains require careful disinterment and examination to maximise the chances for repatriation of the material back to victims' families. By way of contrast, in parts of Australia skeletonised human remains that arrive at forensic centres for evaluation are most often historical material from traditional Aboriginal burial sites.¹⁴

9. Conclusion

This paper has described the process of documentation and handling of multiple fragmented human bones and associated materials that are continually being discovered in the metropolitan area of a major European city. The remains derive from a relatively recent historical conflict and represent local civilians and soldiers from a variety of countries, including Germany. Unfortunately, given the scale of the conflict and destruction, the numbers of the dead, the fragmentation of the remains and the time that has elapsed since the deaths occurred, identification of the remains is generally not feasible, although a small number every year are still being positively identified.

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